

AMENDMENT TO THE CLAIMS

Claim 1 (canceled)

Claim 2 (original) The method of claim 1 wherein determining a condition of the battery includes determining a state of charge of the battery and wherein the charge signal is controlled according to the determined state of charge.

Claim 3 (original) The method of claim 1 wherein controlling the charge signal comprises regulating a charging voltage applied to the battery according to the determined condition of the battery.

Claim 4 (original) The method of claim 2 wherein controlling the charge signal comprises regulating a charging voltage applied to the battery according to the determined state of charge.

Claim 5 (original) An apparatus for monitoring the condition of a storage battery while the storage battery is coupled in parallel to an electrical system of an operating vehicle, comprising:

- a first electrical connection directly coupled to a positive terminal of the battery;
- a second electrical connection directly coupled to a negative terminal of the battery, the first and second electrical connections coupled to a voltmeter to measure a time varying voltage across the battery;
- a third electrical connection directly coupled to the positive terminal of the battery;
- a fourth electrical connection directly coupled to a

negative terminal of the battery, the third and fourth electrical connections coupled to a forcing function having a time varying component;
a current sensor electrically in series with the battery; and
a microprocessor configured to determine the condition of the battery as a function of a dynamic parameter of the battery based upon the measured voltage, the forcing function and the current sensed by the current sensor.

Claim 6 (original) The apparatus of claim 5 further comprising an alternator electrically coupled to the battery and adapted to charge the battery with a charge signal applied to the battery in response to an alternator control signal, wherein the alternator control signal is produced by the microprocessor as a function of the dynamic parameter.

Claim 7 (original) The apparatus of claim 6 wherein the charge signal comprises a charging voltage.

Claim 8 (original) The apparatus of claim 5 wherein the microprocessor is configured to determine a state of charge of the battery as a function of a dynamic parameter of the battery based upon the measured voltage, the forcing function and the current sensed by the current sensor.

Claim 9 (original) The apparatus of claim 8 further comprising an alternator electrically coupled to the battery and adapted to charge the battery with a charge signal applied to the battery in response to an alternator control signal, wherein the alternator control signal is produced by the microprocessor as a function of the determined state of charge.

Claim 10 (original) The apparatus of claim 9 wherein the charge signal comprises a charging voltage.

Claim 11 (original) The apparatus of claim 9 wherein the microprocessor is further configured to produce a vehicle-performance-parameter control signal based upon the determined state of charge, wherein the vehicle-performance-parameter control signal controls a vehicle performance parameter that affects the magnitude of the charge signal applied to the battery.

Claim 12 (original) The apparatus of claim 8 wherein the microprocessor is further configured to determine a state of health of the battery as a function of a dynamic parameter of the battery based upon the measured voltage, the forcing function and the current sensed by the current sensor, wherein the apparatus further comprises a computer memory device configured to store data regarding the starting performance of the battery as a function of state of health and state of charge, and wherein the microprocessor is further configured to determine a likelihood that the vehicle will start based upon the determined state of health, the determined state of charge and the stored starting performance data.

Claim 13 (original) A method of determining the starting capability of a vehicle, comprising:

- determining a state of charge of a vehicle battery;
- determining a state of health of the vehicle battery;
- determining a previous starting performance of the vehicle under similar conditions to the determined state of charge and state of health; and
- determining a likelihood that the vehicle will start based upon the previous starting performance.

Claim 14 (original) A method of controlling the charging rate of a vehicle storage battery during operation of the vehicle, comprising:

- determining the state of charge of the battery;
- charging the battery with a charge signal generated by an alternator; and
- controlling a vehicle performance parameter based upon the determined state of charge, wherein the vehicle performance parameter is a parameter that affects the magnitude of the charge signal generated by the alternator.

Claim 15 (original) A method of detecting that an initially installed vehicle battery has been replaced with a second vehicle battery, comprising:

- measuring a value of a battery performance parameter;
- calculating the difference between the measured value of the performance parameter and a predetermined value of the performance parameter; and
- determining whether the initially installed vehicle battery has been replaced by a second battery based upon the difference between the measured value of the performance parameter and the predetermined value of the performance parameter.

Claim 16 (original) A vehicle storage battery comprising:
a plurality of electrochemical cells, each
having a plurality of positive plates
and a plurality of negative plates;
an enclosure housing the electrochemical
cells and having a positive terminal

and a negative terminal disposed thereon;
a first connector electrically coupling adjacent cells to one another and electrically coupled to the positive terminal;
a second connector electrically coupling adjacent cells to one another and electrically coupled to the negative terminal; and
a computer data storage device contained in or coupled to the enclosure and adapted to store information regarding the battery, the storage device further configured to communicate with a device for testing the battery.

Claim 17 (previously added) An apparatus for monitoring charging of a storage battery in a vehicle, comprising:

an electrical connection to an electrical system of the vehicle, the electrical system including an alternator to charge the battery; and
a microprocessor coupled to the electrical connection and configured to measure a condition of the battery, a charge applied to the battery, and a drive cycle of the vehicle and responsively provide an output related to the battery condition, charge applied to the battery and the drive cycle.

Claim 18 (previously added) The apparatus of claim 17, wherein the output is indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 19 (previously added) The apparatus of claim 17 wherein the output is indicative of a number of drive cycles which the battery can support.

Claim 20 (previously added) The apparatus of claim 17 wherein the connection to the electrical system comprises a four point Kelvin connection.

Claim 21 (previously added) The apparatus of claim 17 wherein the battery condition is related to a response of the battery to a time varying signal.

Claim 22 (previously added) The apparatus of claim 17 wherein the output is provided to an operator.

Claim 23 (previously added) The apparatus of claim 17 wherein the output provides an indication that the vehicle must be driven for an extended period of time.

Claim 24 (previously added) The apparatus of claim 17 wherein the output provides an indication that an alternative charging method must be used.

Claim 25 (currently amended) An apparatus for monitoring use of a storage battery in a vehicle, comprising:

an electrical connection to an electrical system of the vehicle, the electrical system including an alternator to charge the battery; and

a microprocessor coupled to the electrical connection and configured to measure a condition of the battery and monitor charging of the battery by the alternator and store historical charging information and usage information of the storage battery wherein battery condition is related to a response of the battery to the time varying signal.

Claim 26 (currently amended) The apparatus of claim 25 wherein the historical charging information and usage information of the storage battery is stored over a life of the vehicle.

Claim 27 (currently amended) The apparatus of claim 25 wherein the historical charging information and usage information of the battery is stored during manufacturing of the vehicle.

Claim 28 (currently amended) The apparatus of claim 25 wherein the historical charging information and usage information of the battery is stored during delivery of the vehicle.

Claim 29 (previously added) The apparatus of claim 25 wherein the microprocessor is further configured to monitor a drive cycle of the vehicle and responsively provide an output indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 30 (previously added) The apparatus of claim 25 wherein the connection to the electrical system comprises a four point Kelvin connection.

Claim 31 (canceled)

Claim 32 (previously added) The apparatus of claim 25 wherein the microprocessor is configured to communicate with a digital memory of the storage battery.

Claim 33 (previously added) The apparatus of claim 32 wherein communication with the digital memory is through the electrical connection.

Claim 34 (previously added) The apparatus of claim 32 wherein the digital memory contains information related to a rating of the storage battery.

Claim 35 (previously added) An apparatus for monitoring an electrical system of a vehicle having a storage battery, comprising:

- an electrical connection to an electrical system of the vehicle, the electrical system including an alternator to charge the battery; and
- a microprocessor coupled to the electrical system through the electrical connection configured to monitor data points and store them in a memory, the microprocessor configured to observe a loss of one or more phases of an output of the alternator and responsively provide an output.

Claim 36 (previously added) The apparatus of claim 35 wherein the output comprises a "service alternator soon" output.

Claim 37 (previously added) The apparatus of claim 35 wherein the output is communicated to a vehicle microprocessor.

Claim 38 (previously added) The apparatus of claim 35 wherein the microprocessor is further configured to measure a condition of

the battery, charge applied to the battery, and a drive cycle of the vehicle and responsively provide an output related to the battery condition, charge applied to the battery and the drive cycle.

Claim 39 (previously added) The apparatus of claim 38, wherein the output is indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 40 (previously added) The apparatus of claim 38 wherein the output is indicative of a number of drive cycles which the battery can support.

Claim 41 (previously added) The apparatus of claim 35 wherein the connection to the electrical system comprises a four point Kelvin connection.

Claim 42 (previously added) The apparatus of claim 38 wherein the battery condition is related to a response to the battery to a time varying signal.

Claim 43 (previously added) The apparatus of claim 35 wherein the microprocessor is further configured to measure a condition of the battery and monitor charging of the battery by the alternator and store historical charging information and usage information of the storage battery.

Claim 44 (currently amended) The apparatus of claim 43 wherein the historical charging information and usage information of the storage battery is stored over a life of the vehicle.

Claim 45 (previously added) An apparatus for monitoring a storage battery of an automotive vehicle, comprising:

an electrical connection to an electrical system of the vehicle, the electrical system including an alternator to charge the battery to charge the battery and at least one controllable load which draws power through the electrical system; and
a microprocessor coupled to the electrical connector configured to measure a condition of the battery indicative of state of charge (SOC) of the battery and reduce power drawn by the load in response to battery state of charge.

Claim 46 (previously added) The apparatus of claim 45 wherein the microprocessor couples to a databus of the vehicle.

Claim 47 (previously added) The apparatus of claim 45 wherein the microprocessor is further configured to measure a condition of the battery, charge applied to the battery, and a drive cycle of the vehicle and responsively provide an output related to the battery condition, charge applied to the battery and the drive cycle.

Claim 48 (previously added) The apparatus of claim 47, wherein the output is indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 49 (previously added) The apparatus of claim 47 wherein the output is indicative of a number of drive cycles which the battery can support.

Claim 50 (previously added) The apparatus of claim 45 wherein the connection to the electrical system comprises a four point Kelvin connection.

Claim 51 (previously added) The apparatus of claim 45 wherein the condition of the battery is related to a response of the battery to a time varying signal.

Claim 52 (previously added) The apparatus of claim 45 wherein the microprocessor is further configured to measure a condition of the battery and monitor charging of the battery and store historical charging information and usage information of the storage battery.

Claim 53 (previously added) The apparatus of claim 52 wherein the microprocessor is configured to communicate with a digital memory of the storage battery.

Claim 54 (previously added) An apparatus in an automotive vehicle for monitoring a starter motor used to start an engine of the vehicle, the apparatus comprising:

- an electrical connection to an electrical system of the vehicle, the electrical system including a battery and the starter motor; and
- a microprocessor coupled to the electrical connection configured to determine a time to start the engine of the vehicle by the starter motor and detect an imminent failure of the starter motor based upon the time to start the engine of the vehicle by the starter motor.

Claim 55 (previously added) The apparatus of claim 54 wherein the microprocessor monitors a voltage drop of the electrical system to determine the time to start the vehicle by the starter motor.

Claim 56 (previously added) The apparatus of claim 54 wherein the microprocessor determines current required during starting and

imminent starter motor failure is determined based upon the current.

Claim 57 (previously added) The apparatus of claim 56 wherein the determined current comprises average current during starting.

Claim 58 (previously added) The apparatus of claim 56 wherein the determined current comprises peak current required during starting.

Claim 59 (previously added) The apparatus of claim 54 wherein the microprocessor is further configured to measure a condition of the battery, charge applied to the battery, and a drive cycle of the vehicle and responsively provide an output related to the battery condition, charge applied to the battery and the drive cycle.

Claim 60 (previously added) The apparatus of claim 59, wherein the output is indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 61 (previously added) The apparatus of claim 59 wherein the output is indicative of a number of drive cycles which the battery can support.

Claim 62 (previously added) The apparatus of claim 54 wherein the connection to the electrical connector comprises a four point Kelvin connection.

Claim 63 (previously added) The apparatus of claim 59 wherein the battery condition is related to a response to the battery to a time varying signal.

Claim 64 (previously added) The apparatus of claim 54 wherein the microprocessor is further configured to measure a condition of the battery and monitor charging of the battery and store historical charging information and usage information of the storage battery.

Claim 65 (previously added) An apparatus in an automotive vehicle for monitoring a starter motor used to start an engine of the vehicle, the apparatus comprising:

- an electrical connection to an electrical system of the vehicle, the electrical system including a battery and the starter motor; and

- a microprocessor coupled to the electrical connection configured to determine a current required to start the engine of the vehicle by the starter motor and detect an imminent failure of the starter motor based upon the current required to start the engine of the vehicle by the starter motor.

Claim 66 (previously added) The apparatus of claim 65 wherein the determined current comprises average current during starting.

Claim 67 (previously added) The apparatus of claim 65 wherein the determined current comprises peak current required during starting.

Claim 68 (previously added) The apparatus of claim 65 wherein the microprocessor monitors a voltage drop of the electrical system to determine a time to start the vehicle by the starter motor.

Claim 69 (previously added) The apparatus of claim 65 wherein the microprocessor is further configured to measure a condition of the battery, charge applied to the battery, and a drive cycle of the vehicle and responsively provide an output related to the battery condition, charge applied to the battery and the drive cycle.

Claim 70 (previously added) The apparatus of claim 69, wherein the output is indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 71 (previously added) The apparatus of claim 69 wherein the output is indicative of a number of drive cycles which the battery can support.

Claim 72 (previously added) The apparatus of claim 69 wherein the connection to the electrical connector comprises a four point Kelvin connection.

Claim 73 (previously added) The apparatus of claim 65 wherein the microprocessor is further configured to measure a condition of the battery and monitor charging of the battery and store historical charging information and usage information of the storage battery.

Claim 74 (previously added) An apparatus for monitoring a storage battery in an automotive vehicle, comprising:

- an electrical connection coupled to an electrical system of the vehicle, the electrical system including the storage battery; and
- a microprocessor coupled to the electrical connection configured to sense replacement of the storage battery, measure a capacity of the battery, and

responsively provide an indication that a battery capacity is less than a threshold level.

Claim 75 (previously added) The apparatus of claim 74 wherein the threshold is stored in a memory of the vehicle.

Claim 76 (previously added) The apparatus of claim 74 wherein the microprocessor is further configured to measure a condition of the battery, charge applied to the battery, and a drive cycle of the vehicle and responsively provide an output related to the battery condition, charge applied to the battery and the drive cycle.

Claim 77 (previously added) The apparatus of claim 76, wherein the output is indicative of a drive cycle which is insufficient to maintain battery charge.

Claim 78 (previously added) The apparatus of claim 76 wherein the output is indicative of a number of drive cycles which the battery can support.

Claim 79 (previously added) The apparatus of claim 74 wherein the connection to the electrical connector comprises a four point Kelvin connection.

Claim 80 (previously added) The apparatus of claim 74 wherein the battery capacity is related to a response to the battery to a time varying signal.

Claim 81 (previously added) The apparatus of claim 74 wherein the microprocessor is further configured to measure a condition of the battery and monitor charging of the battery and store

historical charging information and usage information of the storage battery.